Lesotho now better prepared to fight animal and zoonotic diseases

By Laura Gil

Diagnosing animal diseases early and rapidly is now possible in Lesotho, a country of two million people in southern Africa that until recently relied on foreign laboratories for analysis. Thanks to the support of the IAEA and the Food and Agriculture Organization of the United Nations (FAO), veterinary scientists in the capital Maseru have since mid-2017 been able to use nuclear-derived techniques to identify and characterize viruses that affect livestock and humans.

"To keep diseases under control and to respond rapidly to any possible outbreaks we need to be able to do our own diagnoses," said Gerard Mahloane, Director of Livestock Services at Lesotho's Ministry of Agriculture and Food Security.

These techniques enable the identification of viruses — including Ebola and avian influenza — within a few hours and with a high degree of accuracy. They are also cost effective. "What before would take weeks to discover, we now see immediately," Mahloane said. "This makes a great difference."

Early diagnosis helps curtail the spread of a disease by making it possible to rapidly isolate and treat infected animals and patients earlier. This enables authorities and farmers to respond quickly to any outbreaks and control them, and to maintain a level of surveillance that will prevent outbreaks.

With the help of these techniques, scientists at the Central Veterinary Laboratory have been able to confirm that Lesotho is free of foot-and-mouth disease, one of the most infectious diseases threatening livestock.

They are using equipment donated by the IAEA to verify whether the country is also free of the peste des petits ruminants (PPR),

The VETLAB Network: Building veterinary laboratory diagnostic capacity in Africa and Asia

To African countries facing the threat of animal disease outbreaks, the use of nuclear-derived techniques is critical for diagnosis and, in turn, containment and eradication.
(Photo: D. Calma/IAEA)

Veterinarians in Africa, working to stop the spread of transboundary animal diseases, including those that can spread to humans, using isotopic, nuclear and nuclear-derived diagnostic techniques, can share best practices, coordinate activities and develop joint disease control strategies through the Veterinary Diagnostic Laboratory (VETLAB) Network. The network was established by the IAEA in partnership with the Food and Agriculture Organization of the United Nations (FAO), and is partially supported through the Peaceful Uses Initiative (PUI).

These diseases can have a dramatic impact on public health and livelihoods. They also pose a major challenge to international trade in products of animal origin, potentially causing serious losses and substantial food safety and food security problems.

The early and rapid detection and characterization of disease pathogens is critical in implementing progressive control strategies, which contribute to containment and eventual eradication. Because such diseases, and the animals that carry them, know no borders, concerted measures are required. The members of the VETLAB Network share their diagnosis and control experience and know-how and promote national and regional animal and zoonotic disease prevention measures. The Network is supported with training courses, transfer of technologies and knowledge sharing, provision of guidance and standard operating procedures, expert services and the provision of equipment, reagents and consumables.

The VETLAB Network currently supports 44 countries in Africa and 19 countries in Asia.

a highly contagious animal disease that can kill thousands of sheep and goats per year. They have already collected all the necessary animal samples, some of which they are processing in the lab. Next, they are also planning to verify whether the country is free of avian influenza, detected in neighbouring South Africa in 2017.

In the past, Lesotho's authorities used to send more than 2000 blood samples of cattle and other animals to South Africa and Botswana for analysis each year to verify whether the country was free of these animal diseases — analyses that are expensive but mandated by the World Organisation for Animal Health (OIE). They now rely on foreign laboratories for confirmation or validation only.

To African countries facing the threat of animal disease outbreaks, the help of the IAEA, in cooperation with the FAO, has been critical in equipping their laboratories and training their scientists in the use of these techniques and the corresponding biosafety measures. Lesotho is the world's second largest producer of mohair, a material made from the country's many sheep and goats. Ensuring that their sheep and goats are healthy helps farmers, producers and exporters secure a steady income.

The IAEA, through its technical cooperation programme and in partnership with the FAO, has been assisting Lesotho in fighting infectious diseases since the country joined the Agency in 2009.

Nuclear-derived techniques have helped authorities demonstrate that Lesotho is free of foot-and-mouth disease.
(Photo: D. Calma/IAEA)

THE SCIENCE

Using nuclear techniques to detect animal diseases

Veterinarians at Lesotho's Livestock Services use various nuclear-derived techniques for the early and rapid diagnosis of animal and zoonotic diseases. Here is how these techniques work.

In serological assays, specific antibodies, unique to each pathogen, are detected using anti-immunoglobulins specific for each animal species tested.

In molecular assays, scientists replicate, or amplify, a specific region of DNA billion-fold in just a few hours. The detection of the amplification of the target DNA is then monitored by either radioisotopes or by fluorescent molecules. The polymerase chain reaction (PCR) is very specific, as it usually targets a specific marker on a given pathogen. It consists of repeated heating and cooling, causing separation of the two DNA-strands and then replication of the original DNA. This procedure gets repeated until enough copies of the targeted molecule are available. Scientists can then identify the presence of the pathogen's genome.

What makes these techniques nuclear-derived?

To visualize these reactions, the reactive molecules (antibodies in serological and genetic fragments in molecular techniques) are labelled with radioactive isotopes such as ^{32}P, ^{33}P, ^{35}S, ^{3}H, ^{14}C, so that the reactions can be measured using counters for radioactive rays or particles. However, where radioactivity is not an option due to the laboratory setup or the short half-life of radioisotopes or where the sensitivity of these techniques is not critically important, radioactive labelling can be replaced with colour-generating substances, such as enzymes or fluorescent dyes. These tags have simpler reading and evaluation processes, but become less reliable over time, decreasing the sensitivity of the techniques. Therefore, nuclear labelling is still used as a reference calibration standard in order to re-establish the accuracy of the visual labelling.